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## Summary of Results

This grant supported the observations and analysis from the Japanese ASTRO-C x-ray satellite Ginga, as part of the Guest Investigator Program. The Japanese host/collaborator was Professor Yoji Osaki of the University of Tokyo. Three cataclysmic variables were observed: BV Pup for 16.5 hrs on April 23-24, 1988; V426 Oph for 47 hrs on Sept. 14-17, 1988 and S193 for 6 hrs on June 14, 1989. Simultaneous or near-simultaneous ground-based observations were conducted during the x-ray observations by M. Strauss, T. Marsh, M. Castelaz and the P.I.

The resulting x-ray data were reduced at the Institute of Space and Astronautical Science (ISAS) in Japan during two trips (October 1988 and November 1989). The background was removed and the fits to the x-ray spectra were done at ISAS, while the timing analysis and correlation with the optical data were accomplished when the data were brought back to the University of Washington.

The following new results were obtained as a result of these observations.

BV PUP: The observations took place during quiescence and the lack of an x-ray detection by Ginga revealed a lower x-ray flux in comparison to data obtained near outburst with EXOSAT. This indicates that the quiescent to outburst scenario is different in this system from normal dwarf novae. The lower accretion rate could indicate that the accretion rate at outburst is not high enough to produce an optically thick boundary layer. On the other hand, since high excitation lines were not present during the Ginga observations, the accretion rate may be highly variable and possibly related to the outburst cycle.

V426 OPH: The x-ray data were obtained near outburst and showed the typical lowered hard x-ray flux which is related to an optically thick boundary layer. The spectrum was best fit with a 14 keV thermal source with a column density of  $1.6 \times 10^{22} \text{ cm}^{-2}$  combined with an unusually strong iron emission line at 6.8 keV. No consistent periodicity was present during the 4 days of optical and x-ray coverage, although there is excess power in the Fourier transform at timescales of 28 min and the total optical and x-ray data set folded on this timescale shows modulated behavior. Two out of seven overlapping sets of data show a correlation between the optical and x-ray in short timescale behavior. The outburst data confirm the large x-ray flux and high column density observed in quiescence. The strong iron emission and the quasi-periodic behavior suggest but do not confirm a possible magnetic nature for the white dwarf.

S193: The Ginga data are the first x-ray observations of this cataclysmic variable. They show a relatively strong flux ( $6.6 \times 10^{-12} \text{ ergs/cm}^2/\text{s}$  in the 2-8 keV range) with a fit to a 15 keV thermal spectrum with column density of  $6.3 \times 10^{21} \text{ cm}^{-2}$ . Although there was strong variability present, there was no periodicity evident at the 19 min period that is usually present in the optical. However, the short data length and interruptions due to earth occultation prevented good determination of periodicities near this length.

## PUBLICATIONS

Szkody, P., Kii, T., Osaki, Y. "Ginga Observations of the Dwarf Novae BV Pup and V426 Oph", 1990, A.J. to appear in Aug. issue.

Szkody, P., Garnavich, P., Howell, S and Kii, T. " New DQ Hers", 1990, Proc. 11th N. American Workshop on CVs and Low Mass X-Ray Binaries, ed. C. Mauche, CUP, in press.